WE CLAIM:

1. Apparatus for bonding soft biological tissue having an incision therein, comprising:

forceps adapted to grip a portion of the tissue on both sides of the incision;

electrodes adapted to contact said tissue portion;

an electrical power source for providing a high frequency electrical signal to said electrodes to be passed through said tissue portion; and

control means coupled to said electrical power source to provide said electrodes with one voltage signal during a first of two stages, and another voltage signal during a second of said two stages.

2. The apparatus of claim 1, wherein said control means controls the voltage signal of said first stage to have a varying level, and the voltage signal of said second stage to have a constant level.

3. The apparatus of claim 2, wherein said control means provides a constant rate of increase in the voltage ~~level~~ of said voltage signal during said first stage.

4. The apparatus of claim 3, wherein said constant rate of increase begins at a voltage of zero.

5. The apparatus of claim 3, wherein said constant rat of increase reaches a maximum voltag during said first stage equal to said constant voltage level applied during said second stage.

6. The apparatus of claim 2, further comprising means for measuring impedance of said tissue portion, wherein said control means controls duration of said first stage in response to said measured impedance.

7. The apparatus of claim 6, wherein said control means controls said constant voltage level of said signal during said second stage based on said measured impedance.

8. The apparatus of claim 7, wherein said control means controls duration of said second stage based on said measured impedance.

9. The apparatus of claim 2, further comprising means for measuring impedance of said tissue portion as a function of time, means for detecting an impedance minimum of said tissue portion after said first stage commences, wherein said control means controls duration of said first stage in response to occurrence of said impedance minimum.

10. The apparatus of claim 9, wherein said control means controls said constant level of said signal based on occurrence of said impedance minimum.

11. The apparatus of claim 10, wherein said control means controls duration of said second stage based on a comparison between a present value of tissue impedance and said impedance minimum.

12. The apparatus of claim 1, wherein said tissue portion is in the form of a flange which includes joined edges of tissue from both sides of said incision and said electrodes engage opposite sides of said flange.

13. The apparatus of claim 12, wherein the forceps includes clamping means for applying force to clamp the flange between said electrodes to thereby compress said tissue portion.

14. The apparatus of claim 13, wherein said clamping means compresses said flange during said first and second stages.

15. The apparatus of claim 14, wherein said clamping means continues to compress said flange for a time period after said second stage is completed.

16. The apparatus of claim 15, wher in the clamping means increases said force during said second stage.

17. The apparatus of claim 13, wherein the clamping means controls said force applied to said flange to a predetermined level.

18. The apparatus of claim 13, wherein said clamping means is mechanical.

19. The apparatus of claim 13, wherein said clamping means is electromagnetic.

20. The apparatus of claim 1, wherein said power source provides a frequency in the range of 50K to 2000K Hz.

21. The apparatus of claim 1, wherein said control means modulates said constant voltage level during at least said second stage by a low frequency signal.

22. The apparatus of claim 20, wherein said low frequency signal is in the range of 4 to 6 HZ.

23. Apparatus for bonding soft biological tissue having an incision therein, comprising:

forceps adapted to grip a portion of the tissue on both sides of the incision;

electrodes adapted to contact said tissue portion;

an electrical power source for providing a high frequency electrical signal to said electrodes to be passed through said tissue portion; and

clamping means for applying force with said forceps to compress said tissue portion, said force being set to different levels in two time periods, respectively, while said high frequency electrical signal is being passed through said tissue portion.

24. The apparatus of claim 23, wherein said tissue portion is in the form of a flange which includes joined edges of tissue from both sides of said incision.

25. The apparatus of claim 24, wherein the level of said force applied in a first of said two time periods is lower than the level of said force applied in a second of said two time periods.

26. The apparatus of claim 25, wherein the force level during said first time period is substantially constant.

27. The apparatus of claim 26, wher in the force lev l during said second time period is substantially constant.

28. The apparatus of claim 27, wherein said second time period follows immediately after said first time period.

29. The apparatus of claim 27, wherein said clamping means applies a force to said tissue portion after passing of said high frequency electrical signal through said tissue portion is stopped.

30. The apparatus of claim 29, further comprising a control means coupled to said electrical power source to provide said electrodes with one voltage signal during a first of two stages, and with a different voltage signal during a second of said two stages.

31. The apparatus of claim 30, wherein said first and second time periods correspond to said first and second stages, respectively.

32. The apparatus of claim 23, wherein said clamping means applies a force to said tissue portion after passing of said high frequency electrical signal through said tissue portion is stopped.

33. The apparatus of claim 23, further comprising a control means coupled to said electrical power source to provide said electrodes with one voltage signal during a first of two stages, and with a different voltage signal during a second of said two stages.

34. The apparatus of claim 33, wherein said first and second time periods correspond to said first and second stages, respectively.

35. Apparatus for bonding soft biological tissue having an incision therein, comprising:

forceps adapted to grip a portion of the tissue on both sides of the incision;

electrodes adapted to contact said tissue portion;

an electrical power source for providing a high frequency electrical signal to said electrodes to be passed through said tissue portion; and

control means for providing a constant voltage level of said signal during at least a portion of a time period when said high frequency electrical energy is passed through said tissue portion, and for modulating said constant level by a low frequency signal.

36. The apparatus of claim 35, wherein the frequency of said low frequency signal is in the range of 4 to 6 HZ.

37. The apparatus of claim 36, wher in the fr quency of said high frequency signal is in the range of 50 kHz to 2000 kHz.

38. The apparatus of claim 36, wherein said low frequency signal is a substantially square pulse.

39. Apparatus for bonding soft biological tissue having an incision therein, comprising:

forceps adapted to grip a portion of the tissue on both sides of the incision;

electrodes secured to said forceps for contacting said tissue portion;

an electrical power source for providing a high frequency electrical signal to said electrodes to be passed through said tissue portion; and

wherein said electrodes are dimensioned relative to size of said tissue portion to be an effective heat sink for conducting heat away from said tissue and thereby prevent sticking of tissue to said electrodes.

40. The apparatus of claim 39, wherein said electrodes are dimensioned to have a volume which is at least 5 times that of the tissue portion volume.

41. The apparatus of claim 40, wherein said electrodes are made of a metal with a high heat conductivity.

42. Apparatus for bonding soft biological tissue having an incision therein, comprising:

forceps adapted to grip a portion of the tissue on both sides of the incision;

electrodes adapted to contact said tissue portion;

an electrical power source for providing an electrical signal to said electrodes to be passed through said tissue portion;

means for predetermining impedance variation in said tissue portion as a function of time while said electrical signal passes through said tissue portion, and to provide a preselected impedance value;

means for measuring impedance of said tissue portion to provide a measured impedance signal as a function of time while said electrical signal passes through said tissue portion; and

means for stopping said electrical signal from being passed through said tissue portion when a value of the measured impedance signal reaches a preset impedance value relative to said preselected impedance value, said preselected impedance value being specific in particular to the biological tissue being bonded.

43. Th apparatus of claim 42, wherein said measuring means includes a voltage sensor, a current sensor and means to calculate a ratio therebetween.

44. A method for bonding soft biological tissue having an incision therein, comprising the steps of:

gripping a portion of the tissue on both sides of the incision with forceps;

contacting said tissue portion with electrodes;

providing a high frequency electrical signal to said electrodes to be passed through said tissue portion; and

providing said electrodes with one voltage signal during a first of two stages, and another voltage signal during a second of said two stages.

45. A method for bonding soft biological tissue having an incision therein, comprising the steps of:

gripping a portion of the tissue on both sides of the incision with forceps;

contacting said tissue portion with electrodes;

providing a high frequency electrical signal to said electrodes to be passed through said tissue portion; and

applying force with said forceps to compress said tissue portion, said force being s t to different levels in

two time p riods, resp ctiv ly, while said high frequency lectrical signal is being passed through said tissue portion.

46. A method for bonding soft biological tissue having an incision therein, comprising the steps of:

gripping a portion of the tissue on both sides of the incision with forceps;

contacting said tissue portion with electrodes;

providing a high frequency electrical signal to said electrodes to be passed through said tissue portion; and

providing a constant voltage level of said signal during at least a portion of a time period when said high frequency electrical energy is passed through said tissue portion, and modulating said constant level by a low frequency signal.

47. A method for bonding soft biological tissue having an incision therein, comprising the steps of:

gripping a portion of the tissue on both sides of the incision with forceps;

contacting said tissue portion with electrodes;

providing a high frequency electrical signal to said electrodes to be passed through said tissue portion; and

dimensioning said electrodes relative to size of said tissue portion to be an ffective heat sink for conducting heat away from said tissue and thereby prevent sticking of tissue to said electrodes.

48. A method for bonding soft biological tissue having an incision therein, comprising the steps of:

gripping a portion of the tissue on both sides of the incision with forceps;

contacting said tissue portion with electrodes;

providing an electrical signal to said electrodes to be passed through said tissue portion;

predetermining impedance variation in said tissue portion as a function of time while said electrical signal passes through said tissue portion, and providing a preselected impedance value;

measuring impedance of said tissue portion to provide a measured impedance signal as a function of time while said electrical signal passes through said tissue portion; and

stopping said electrical signal from being passed through said tissue portion when a value of the measured impedance signal reaches a preset impedance value relative to said preselected impedance value, said preselected

impedance value being specific in particular to the biological tissue being bonded.

49. The apparatus of claim 1, wherein said electrodes are secured to said forceps.

50. The apparatus of claim 23, wherein said electrodes are secured to said forceps.

51. The apparatus of claim 35, wherein said electrodes are secured to said forceps.

52. The apparatus of claim 42, wherein said electrodes are secured to said forceps.

53. The apparatus of claim 42, wherein said preselected impedance value is substantially a minimum impedance.

54. The method of claim 48, wherein said preselected impedance value is a substantially minimum impedance.

55. The method of claim 42, further comprising means to store said preselected impedance value.

56. The method of claim 42, wherein said stopping means calculates a ratio b tween said measured impedanc signal and said preselected impedance value to determine when said preset impedance value is reached.

57. The method of claim 48, further comprising the step of storing said preselected impedance value.

58. The method of claim 48, wherein said stopping step calculates a ratio between said measured impedance signal and said preselected impedance value to determine when said preset impedance value is reached.

59. Apparatus for bonding soft biological tissue having an incision therein, comprising:

forceps adapted to grip a portion of the tissue on both sides of the incision;

electrodes adapted to contact said tissue portion in an electrode/tissue contact area;

an electrical power source for providing a high frequency electrical signal to said electrodes to be passed through said tissue portion; and

wherein said electrodes are dimensioned relative to size of said tissue portion to maintain uniformity in said electrode/tissue contact area.

60. The apparatus of claim 59, wherein said el ctrod s are dimensioned such that a length of said electrode/tissue contact area is at least as large as a thickness of said tissue portion.

61. A method for bonding soft biological tissue having an incision therein, comprising the steps of:

gripping a portion of the tissue on both sides of the incision with forceps;

contacting said tissue portion with electrodes in an electrode/tissue contact area;

providing a high frequency electrical signal to said electrodes to be passed through said tissue portion; and

dimensioning said electrodes relative to size of said tissue portion to maintain uniformity in said electrode/tissue contact area.

62. Apparatus for bonding soft biological tissue having an incision therein, comprising:

forceps adapted to grip a portion of the tissue on both sides of the incision;

electrodes adapted to contact said tissue portion;

an electrical power source for providing an electrical signal to said electrodes to be passed through

said tissue portion;

means for measuring imp dance of said tissue portion as a function of time while said electrical signal passes through said tissue portion;

means for determining and storing a minimal value of tissue impedance while said electrical signal passes through said tissue portion;

means for determining a ratio of said measured tissue portion impedance to said minimal value of tissue impedance while said electrical signal passes through said tissue portion after said impedance reaches its minimal value; and

means for stopping said electrical signal from being passed through said tissue portion when said impedance ratio reaches a preset value, said preset value being specific for each bonded biological tissue.

63. A method for bonding soft biological tissue having an incision therein, comprising the steps of:

gripping a portion of the tissue on both sides of the incision with forceps;

contacting said tissue portion with electrodes;

providing a gradually rising voltage to said electrodes for passing electric current through said tissue portion, the rate of the voltage rise being specific for each bonded biological tissue;

m asuring impedance of said tissu portion as a function of time while said voltag is provided to said electrodes;

determining and storing a minimal value of said impedance;

stabilizing the high frequency voltage at a level corresponding to said minimal impedance value;

determining a ratio of said measured tissue portion impedance to said minimal value; and

stopping said high frequency voltage from being passed through said electrodes when said impedance ratio reaches a preset value, said preset value being specific for each bonded biological tissue.